CLAIMS

1. A method of producing a fibre or filament comprising the steps of:

forming a substrate in the form of an elongate core having a core axis;

coating the substrate directly, or indirectly, with a substance having at least one electrically modulatable optical characteristic; and

associating with the substrate, an electrical stimulation means adapted to produce an electric field extending in a direction substantially parallel to the core axis or in a direction extending substantially circumferentially about the core axis, wherein the electric field electrically induces a change in the optical characteristic of the substance, thereby changing the visual appearance of the fibre or filament.

2. The method of claim 1, wherein the substrate is formed from a material adapted to be electrically insulating.

3. The method of claim 1 or claim 2, wherein the forming step includes selecting the mechanical properties of the substrate.

4. The method of any one of the preceding claims, wherein the elongate core is formed to be substantially cylindrical.

5. The method of any preceding claim, further comprising a plurality of associating steps, each associating step associating with the substrate a further electrical stimulation means adapted to produce an electric field extending in a direction substantially parallel to the core axis or in a direction extending substantially circumferentially about the core axis, wherein the electric field electrically induces a change in the optical characteristic of the substance, thereby changing the visual appearance of the fibre or filament.

6. The method of claim 5, wherein the, or each, associating step comprises the steps of arranging the stimulation means such that it forms an

elongate stimulation layer extending in a direction substantially parallel to the core axis, and being substantially coaxial with the core.

7. The method of any preceding claim, further comprising a plurality of coating steps, each coating step coating the substrate directly, or indirectly, with a substance having at least one electrically modulatable optical characteristic.

8. The method of claim 7, wherein the, or each, coating step arranges the substance into an elongate substance layer extending in a direction substantially parallel to the core axis and being substantially coaxial with the core.

9. The method of claim 7 or claim 8, further comprising the step of associating each substance layer with at least one stimulation layer.

10. The method of any preceding claim, wherein the coating step comprises depositing the substance by any one of the following techniques: dip coating, spray coating, vapour deposition and sputtering.

11. The method of claim 6, wherein the, or each, stimulation layer comprises an electrode layer, and the, or each, associating step associates an outer surface of the substrate with the electrode layer.

12. The method of claim 6, wherein the, or each, stimulation layer comprises an adhesion layer and an electrode layer, and the associating step associates an outer surface of the substrate with the adhesion layer followed by the electrode layer.

13. The method of claim 12, wherein the, or each, adhesion layer is deposited by sputtering or vapour deposition, and has a thickness in the range of 1 to 5 nm.

14. The method of claim 13, wherein the, or each, adhesion layer is formed from either titanium, molybdenium or chromium, or alloys thereof.

15. The method of claim 8, wherein an outer surface of the substrate is coated by a substance layer and the associating step associates the substance layer with a stimulation layer comprising an electrode layer.

16. A method of producing a fibre or filament comprising the steps of:

forming a substrate in the form of an elongate core having a core axis;

coating the substrate directly, or indirectly, with a substance having at least one electrically modulatable optical characteristic; and

associating with the substrate, an electrical stimulation means comprising a first and a second electrode pair adapted to produce an electric field extending in a direction substantially parallel to the core axis or in a direction extending substantially transversely to the core axis, wherein the first and second electrodes are disposed in the same off-axis plane, and wherein the electric field electrically induces a change in the optical characteristic of the substance, thereby changing the visual appearance of the filament or fibre.

17. The method of claim 16, wherein the electrical stimulation means further comprises an electrode layer containing the first and second electrode pair, the electrode layer having a plane corresponding to the off-axis plane.

18. The method of claim 11, or claim 12, or claim 17, or any claim dependent thereon, wherein the electrode layer is deposited by sputtering or vapour deposition, and has a thickness in the range of 10 to 400 nm.

19. The method of claim 11, or claim 12, or claim 17, or any claim dependent thereon, wherein the electrode layer is selected to be one of the following metals: gold, silver, platinum and copper, or an alloy containing any of these metals to a substantial degree, such as indium tin oxide, or one of the

following at least partially conductive oligomers or polymers: polyaniline, and poly(3,4-ethylenedioxythiophene) (PEDOT) and derivatives thereof.

20. The method of any of claims 11 to 15, or claim 17 to 19,comprising the step of structuring the electrode layer into an array of electrodes, the structuring step following deposition of the electrode layer.

21. The method of claim 20, wherein the electrode layer is structured into a plurality of electrode arrays, each array being electrically independent of the other electrode arrays.

22. The method of claim 20 or claim 21, wherein the step of structuring is selected from any one of the following: atom-by-atom deposition techniques, lithographic methods including soft lithographic methods, X-ray lithography and particle beam techniques.

23. The method of claim 20 or claim 21, wherein the step of structuring comprises the steps of:

coating an outer surface of the electrode layer with a photoresistive substance;

covering the coated outer surface of the electrode layer with an illumination mask, the illumination mask defining the pattern of the electrode array;

irradiating the photoresistive substance through the illumination mask;

and submersing the coated electrode layer in a developing solution;

wherein the exposed sections of the photoresistive substance are removed by an etchant, in the case of a positive resist, to produce the electrode array, and wherein the masked sections of the photoresistive substance are removed by an etchant in the case of a negative resist, to produce the electrode array.

24. The method of claim 23, wherein the photoresistive substance is selected to be a diazonaphtoquinone (DNQ)-based photoresist dispersed in a phenolic matrix resin, and the developing solution is selected to be an aqueous alkaline solution, such as metal hydroxide solutions, for example potassium hydroxide and sodium hydroxide, and non-metal containing solutions, such as tetramethylammonium hydroxide solution.

25. The method of claim 20 or claim 21, wherein the step of structuring comprises the steps of:

inking a flexible stamp having a surface relief pattern defining a pattern of the electrode array;

applying the stamp to an outer surface of the electrode layer to deposit a layer, including a monolayer, of ink in the pattern of the electrode array; and

submersing the electrode layer in an etchant to remove the un-inked sections of the electrode layer.

26. The method of claim 25, comprising the further step of submersing the electrode layer in a further etchant to remove the exposed sections of the adhesion layer, after the electrode has been submersed in the etchant.

27. The method of claim 20 or claim 21, wherein the step of structuring comprises the steps of:

inking, using a first ink, a flexible stamp having a surface relief pattern defining a pattern of the electrode array;

applying the stamp to an outer surface of the electrode layer to deposit a layer of the first ink in the pattern of the electrode array;

depositing a second ink onto the sections of the outer surface of the electrode layer not inked by the first ink; and

submersing the electrode layer in an etchant to remove the sections of the electrode layer inked by the first ink.

28. The method of claim 27, wherein the step of depositing may include any of the following: deposition from solution, deposition from the gas phase and application of a stamp.

29. The method of any one of claims 25 to 28, wherein the applying step includes holding the stamp at rest and rolling the outer surface of the electrode layer across the pattern of the electrode array.

30. The method of claim 11, comprising the step of structuring the electrode layer into an array of electrodes, wherein the step of structuring comprises the steps of:

inking a flexible stamp having a surface relief pattern defining a pattern of the electrode array, the ink consisting of a suspension of a metal precursor;

applying the stamp to an outer surface of the substrate to deposit a layer of ink in the pattern of the electrode array; and

thermally processing the deposited ink to convert the metal precursor held in suspension into a plurality of metal electrodes arranged in the pattern of the electrode array.

31. The method of claim 30, wherein the metal precursor is selected to be one of the following: metal micro- or nano-particles and metal clusters.

32. The method of claim 11, comprising the step of structuring the electrode layer into an array of electrodes, wherein the step of structuring comprises the steps of:

bringing a flexible stamp, having a surface relief pattern, into contact with a support surface bearing a metal layer, wherein the flexible stamp material and support surface material are pre-selected such that the adhesion of the metal to the stamp overcomes the adhesion of the metal to the support surface, so that the metal will selectively adhere only to elevated regions of the surface relief pattern of the stamp; and

applying the prepared stamp to an outer surface of the substrate to deposit the metal layer in the pattern of the electrode array.

33. The method of any one of the preceding claims, wherein the step of forming includes directly coating an outer surface of the substrate with a protective layer.

34. The method of claim 33, wherein the protective layer is deposited by any one of the following techniques: dip coating, spray coating, vapour deposition and sputtering.

35. The method of claim 33 or claim 34, wherein the protective layer is adapted to be resistant to chemical etchants.

36. The method of any preceding claim, further comprising the step of adding spacer means.

37. The method of claim 36, wherein the spacer means comprise a plurality of substantially spherical beads and/or one or more spacer wires extending in a direction substantially parallel to the core axis.

38. The method of claim 37, wherein the substance is adapted to substantially contain the spherical beads.

39. The method of claim 36, wherein the adding step includes attaching the spacer means to an outer surface of the electrode layer.

40. The method of claim 7 or claim 8, or any claim dependent thereon, further comprising the step of covering the substance layer with one or more outer layers.

41. The method of any preceding claim, wherein the substrate is made from a flexible polymer fibre.

42. The method of claim 41, wherein the flexible polymer fibre is selected from any one of polyester, polyamide, acrylic, polypropylene, vinyl-based polymers, wool, silk, flax, hemp, linen, jute, rayon, cellulose acetate and cotton fibres.

43. The method of any preceding claim, wherein the electrically modulatable substance is selected to be an inorganic or organic electro-luminescent material or a liquid crystal material.

44. The method of any preceding claim, wherein the optical characteristic of the substance is selected to be the colour.